Residential Energy Codes in the Great Lakes Region

Current Status of Residential Energy Codes in the Great Lakes Region

Residential energy codes are mandatory statewide in most states in the Great Lakes region. The exception is Illinois. There is no statewide building code in Illinois, but municipalities may adopt an energy code. It is estimated that one quarter of Illinois municipalities have adopted an energy code. Some of them, including the City of Chicago, have adopted the 2000 International Energy Conservation Code (IECC). Enforcement of the Chicago Energy Conservation Code has been postponed until September 3, 2002 due to fiscal constraints.

Pennsylvania has the oldest code in the region, the ASHRAE 90A-80 and 90B-75. In November 1999, Pennsylvania enacted a Uniform Construction Code Act establishing a mandatory statewide building code for the first time. That law mentions the adoption of the BOCA National Building Code/1999 and requires the adoption of successor codes no later than December 31 in the year in which they are issued. The BOCA National Building Code/1999 was succeeded by the International Building Code in January 2000. Pennsylvania is catching up and expects to adopt the 2000 IECC by December 2002. The standards would go into effect 90 days after they are adopted.

Indiana presently has the 1992 Model Energy Code (MEC). Indiana announced its intention to revise the Indiana Energy Conservation Code on March 1 2002 in the *Indiana Register*. According to the Building Code Assistance Project of the United States Department of Energy, the Indiana Department of Commerce has received a grant to study adoption of the 2000 IECC in Indiana.

The Minnesota state energy code is based on the 95 MEC. However, the Minnesota code has elements, such as air leakage sealing and ventilation, that go well beyond the requirements of the 95 MEC. The Minnesota Department of Administration, Building Codes & Standards Division will be putting together a task force to consider the adoption of the 2000 IECC. Ohio and Wisconsin have codes based on the 1995 MEC. New York adopted the 2000 IECC with amendments in May 2002.

2000 IECC	Considering 2000 IECC	1995 Model Energy Code
City of Chicago New York	Pennsylvania (ASHRAE 90A-80 & 90B-75) Indiana (92 MEC) Minnesota (95 MEC)	Ohio Wisconsin

Comparison of Michigan Uniform Energy Code to Energy Codes in the Region

Michigan developed its own energy code following Department of Labor adoption of the Model Energy Code and subsequent repeal of the rules by the Legislature. In 1996 a committee consisting of homebuilders, code officials, and other interested parties began

drafting the Michigan Uniform Energy Code. The Department of Consumer and Industry Services promulgated the code in 1999.

Even the states that have adopted one of the model codes have personalized their codes in various ways. For example, New York made an adjustment to the IECC foundation insulation requirements to meet a payback (10 year simple payback) statute. The R-values remained the same, but depth of insulation was modified for degree-day zones, varying from 24" below grade to full height. Wisconsin has different requirements for non-electrically heated homes and electrically heated homes. For example, the ceiling insulation requirement for non-electrically heated homes is R-38.5 and the requirement for electrically heated homes is R-50. Minnesota has a two-tier code – a mandatory standard that is based on the 1995 Model Energy Code and a voluntary standard that is equivalent to a Five Star or ENERGY STAR level of efficiency. Minnesota also has a unique provision in their law that mandates the Department of Public Service to adopt energy code rules that "equal or exceed the most energy-conserving codes adopted by any other state".

Compliance with the national model energy codes or the MUEC can be determined in one of three ways:

- On a prescriptive basis where the minimum values or criteria for building components are specified,
- On a whole-house performance or systems analysis basis, where total building use for the proposed building may be no greater than the energy budget of a "standard" building that meets code, and
- On a component performance basis where the thermal performance of the building envelope and other criteria are specified.

It is difficult to make direct comparisons between the different energy codes because the codes are structured differently. The following chart is intended to generally illustrate the differences between the 2000 IECC adopted by New York State and the MUEC.

Building Component	MUEC Zone 1	2000 IECC (NY)	MUEC Zone 2	2000 IECC (NY)	MUEC Zone 3	2000 IECC (NY)
Walls	R 13	R 21 *	R 15	R 21 *	R 19	R21 *
Windows Up to & including 15% gross exterior wall area	R 1.9	R 2.5	R 1.9	R 2.5	R 1.9	R 2.5
Windows Over 15% and including 20% gross exterior wall area	R 2.5	R 3.0	R 2.5	R 3.0	R 2.5	R 3.0
Roof/ceiling	R 30	R 49	R 38	R 49	R 38	R 49
Floors over unconditioned spaces	R 21	R 19	R 30	R 19	R 30	R19
Unheated slab-on-grade floors	R 5		R 5		R 5	
Heated slab-on-grade floors	R 10	R 7	R 10	R 9	R 10	R 9
Crawl space walls	R 5	R 17	R 5	R 17	R 5	R17
Finished lower level walls	R 5	R 10	R 5	R 10	R 5	R 16
Exposed basement walls	R 5	R 10	R 5	R 10	R5	R 16

* It should be noted that the tradeoff flexibility of the IECC means that prescriptive requirements are frequently not used. In some parts of New York many builders trade off so that they can still build R-13 2x4 walls.

MECcheck, computer software available from the U.S. Department of Energy, was used to compare the MUEC to 1992 MEC, 1993 MEC, and 1995 MEC and the 2000 IECC. The computer generates a U value for a house and compares it to a maximum U value that must not be exceeded if the house is to comply with the energy code. A single-story 2,000 sq. ft. MUEC house obtained a 450 value that exceeded the 2000 IECC maximum U value of 312. There was very little difference in the maximum U values when the computer was asked to make a comparison to the 1992 MEC, 1993 MEC, and 1995 MEC.

Basic residential requirements have not changed dramatically as the codes have changed over the years. The primary changes for single-family housing were in 1992. There were multi-family and duct insulation changes in 1993 and duct sealing changes in 1995.

The specifications for the MUEC house were changed as follows by Energy Office staff to achieve a U value that was less than or very close to the 2000 IECC maximum value of 312:

	Option 1	**Option 2**	**Option 3**
Walls	R-13 to R-21	R-13 to same	R-13 to R-21
Ceilings	R-30 to R-49	R-30 to R-49	R-30 to R-49
Windows	R-2 to R-2.5	R-2 to R-2.5	R-2 to R-2.5
Basement	R-5 to R-10	R-5 to R-10	R-5 to same
Furnace	78 AFUE to same	78 to 90 AFUE	78 to 90 AFUE

Federal Requirements

The National Energy Policy Act (EPAct) signed into law by President Bush in 1992 determined that the 1992 Model Energy Code was the most energy efficient standard for residential construction and required states to determine if it was appropriate to revise their energy codes to meet or exceed it. EPAct also requires the U.S. Department of Energy to review new standards and determine whether they are cost effective. Once DOE has made a determination on the standard, each state has two years to review the new standard and certify whether their state building code meets or exceeds the standard. The U.S. Department of Energy determined that the 93 MEC and then the 95 MEC provided the most cost effective residential standards.

DOE has issued a determination that the 1998 and 2000 editions of the International Energy Conservation Code (IECC) will improve energy efficiency in residential buildings. This process was completed and signed on January 4, 2001. Each state is required to certify to DOE by January 10, 2003, that it has reviewed the provisions of its residential building code regarding energy efficiency and made a determination as to whether it is appropriate for the state to revise its residential building code to meet or exceed the 2000 IECC. If a state determines that it is not appropriate to revise its residential code to meet or exceed the 2000 IECC, the state is required to explain why in writing to the Secretary of Energy.

The Department of Consumer and Industry Services receives funding from the United States Department of Energy for its Energy Office. The grant agreement contains a number of mandatory measures. One of these measures is "mandatory thermal efficiency standards for new and renovated buildings shall.... for all new single-family and multifamily low-rise residential buildings, be no less stringent than the Model Energy Code, 1993." As a result, the Energy Office is technically not in compliance with the terms of the State Energy Program grant agreement.

Review of Energy Savings Estimates for Residential Energy Codes

The Michigan Uniform Energy Code (MUEC) replaced the ASHRAE 90A-80 and 90B-75 code on March 31, 1999. An analysis by the Energy Office estimated a 7.3% energy

savings and that houses built and purchased in one year would generate an annual net savings (energy cost saving minus mortgage increases) of $341,000 for those homeowners.

A 2002 study by the Pacific Northwest National Laboratory for the U.S. Department of Energy investigated the potential savings resulting from adoption of the IECC in Chicago. Since there is no statewide building code in Illinois, current practice was based on survey data collected by the National Assoc. of Home Builders Research Center and anecdotal information available from individuals familiar with new home construction in Illinois. The assumptions about current practice in northern Illinois were close to the MUEC requirements for Zone 1 (ceiling insulation – R 30, wall insulation – R 13, and windows – R 1.9/R 2.08).

Additional construction costs for the Chicago area to meet the IECC requirements were estimated to be $1,827 for a two-story, single-family house with a conditioned floor area of 2,240 sq. ft. Annual energy savings were estimated to be 25% or $261. Assuming a 30-year mortgage, the mortgage increased by $137 because of the additional costs and there was a positive cash flow for the homeowner. They also estimated that the property taxes would increase by $20, but that this would be more than offset by an increase in the income tax deduction of $37. The simple payback figure for the additional costs would be 7.0 years ($1,827 divided by $261).

Compliance Issues for Home Builders

Understanding and determining compliance with an energy code is an important issue for homebuilders. Ideally, compliance should be as simple and easy as possible. One of the goals of the committee developing the Michigan Uniform Energy Code was simplicity and ease of application. The search for simplicity has also been under way on the national level. The most notable change in the residential buildings portion of the 2000 IECC is a new Chapter 6 containing a four page optional and stand alone prescriptive compliance approach. This approach can only be used if the window area is less than or equal to 15% of the wall area for single-family, and less than or equal to 25% of the wall area for multi-family. Chapter 6 is not intended to create any new or different requirements, only a simpler prescriptive approach.

The prescriptive path for compliance with the Michigan Uniform Energy Code is simple to use. Based on the experience of the Bureau of Construction Codes, compliance with the systems, or performance, path is typically done by using software available for one of the national model codes. No software has been developed to assist compliance with the Michigan Uniform Energy Code.

Enforcement Issues for Code Officials

Various studies have indicated that compliance with building energy codes may not be high. A study at the University of Washington of state building energy code administrators, funded by the National Science Foundation, surveyed 33 states with

broad-based code authority. The respondents indicated that "energy codes are too complex and design professionals do not pay sufficient attention." (May, et al. 1995). Another study of building energy codes in California, Washington, and Oregon conducted by Lawrence Berkeley National Laboratory found "that many homes do not meet energy codes...." (Vine 1996). A 1995 statewide study by Minnesota of their energy code found that "The full energy-saving benefits of the code changes are not being realized because in many cases they are not being implemented." (Noble 1995). A Massachusetts study found that checking of window and wall areas in building plan review by code officials was "uncommon" and site inspections of component areas were "very rare". (Lee 2001).

A study conducted for the State of Oregon is more favorable. Although the study found that prescriptive compliance in Oregon was low, it also found that overall compliance and performance were quite uniform throughout the state. More importantly, the study found that Oregon's code had been integrated into building practice. (Ecotope 1994).

No similar study of compliance in Michigan has been conducted.

Home Energy Ratings as a Compliance Option

Can home energy ratings be used to enhance compliance? Early drafts of the Michigan Uniform Energy Code contained a provision that allowed builders to show compliance with a Home Energy Rating analysis.

A home energy rating analysis is the same approach as the performance analysis referenced in the MEC. The energy calculations necessary to assign a rating provide a means for comparing a house's energy performance with a base case or reference house. Home energy ratings have a scale from 0-100 points.

- Energy ratings provide potential advantages over traditional methods for determining code compliance. These benefits include: ratings can provide documentation for increasing a home's appraised value,
- Ratings can help home buyers compare homes,
- Ratings provide the economic data necessary to make tradeoffs among competing housing components,
- Performance analysis encourages design beyond prescriptive code requirements, and
- Energy raters can reduce the workload of public code inspection personnel.

A number of states and local jurisdictions are beginning to use energy ratings for determining code compliance. One of the first state HERS programs to be used for code compliance was the NYSTAR program in New York. New York State benchmarked the HERS program to the New York Energy Code and the NYSTAR rating was acknowledged by state officials as a "deemed-to-comply" method.

Summary

Michigan is not the outlier with respect to residential energy codes in the Great Lakes region that has sometimes been portrayed. Illinois has no statewide energy conservation code whatsoever, and Pennsylvania continues to use, at least for a few more months, the outdated standard replaced by Michigan in 1999. Adopting a residential code is a process of balancing the energy conservation, comfort, affordability, enforcement, and technical issues. Michigan did this in 1999. Under Michigan's law codes are revised on a three-year cycle. It is therefore time to initiate the revision process.

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